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THE FIELD STATUS OF PARASITES OF THE EUROPEAN CORN BORER IN THE FALL OF 1938

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Surveys to determine the current status of parasites of the European corn borer, with special emphasis on localities where imported species had been released, were conducted in the fall of 1938. The section-random-sampling method was used in all surveys, the location of samples being determined by use of polar coordinate or transect designs of a type suitable to the objective sought at each point. The total number of samples taken in the Lake States and Eastern States areas was 424, averaging 88 borers per sample. Thus, a total of 37,309 larvae were collected at the various points surveyed in the 2 areas. A summary of the results of observations in both areas is given in tables 1 and 2.

Table 1.--Parasitization of borers collected at all points surveyed in Lake States area, fall of 1938

State and county or area	Township	Borers observed	<i>Lydella grisescens</i> issued in--	<i>Panzeria pentatalis</i> issued in--	<i>Zenillia caesar</i> issued in--	<i>Lydella</i> sp. issued in--	Undetermined											
			Laboratory	Field	Total	Laboratory	Laboratory	Field	field									
		No.	No.	%	No.	%	No.	%	No.	%								
Indiana:																		
Stauben:	York	486	0	-	0	-	0	0.2	1	0.2	0	0.4	0	-				
Michigan:																		
Monroe:	Erie	585	28	4.8	65	11.1	93	15.9	2	.3	0	-	0	-				
Lake Erie																		
Shore and																		
Detroit																		
River:	--	3,337	17	.5	197	5.9	214	6.4	1	-	7	.2	15	0.4	0	-	7	0.2
Ohio:																		
Erie:	Perkins	535	32	6.0	172	32.1	204	38.1	1	.2	0	-	0	-	0	-	0	-
Logan:	Richland	318	0	-	0	-	0	-	1	.3	0	-	0	-	0	-	0	-
Lucas:	Adams	356	1	.3	0	-	1	.3	0	-	0	-	0	-	0	-	1	.3
Do:	Jerusalem	4,373	73	1.7	497	11.4	570	13.0	2	.5	1	.2	0	-	0	-	11	.2
Lake Erie																		
Shore:	--	3,551	33	.9	232	6.5	265	7.5	10	.3	1	.2	18	.5	0	-	22	.6
Total:	--	13,541	184	--	1,163	--	1,347	--	18	--	10	--	33	--	2	--	41	--

Table 1.--Parasitization of borers collected at all points surveyed in Lake States area, fall of 1938.--(Cont'd.)

State and county or area	Township	Total Diptera	Chelonus annulipes issued in laboratory	Eulophus viridulus issued in laboratory	Labrorynchus prismaticus issued in laboratory	Total exotic parasites	Total parasites
		No.	%	No.	%	No.	%
Indiana:							
Stauben	York	4	0.8	0	-	0	0.8
Michigan:							
Monroe	Erie	95	16.2	0	-	94	16.1
Lake Erie							
Shore and							
Detroit River		244	7.3	0	-	244	7.3
Ohio:							
Erie	Perkins	205	38.5	0	-	204	38.1
Logan	Richland	1	.3	0	-	0	-
Lucas	Adams	2	.6	4	1.1	5	1.4
Do-	Jerusalem	584	13.4	0	-	589	13.5
Lake Erie Shore		316	8.9	0	-	266	7.5
Total		1,451		4		1,372	
							1,477

Table 2.--Parasites recovered in the Eastern States area, fall of 1938

Survey region	Borers observed	Inareo	Lydella	Macrocen	Chelonus	Cremastus	Bassus	chus	Undeter	flavo	agilis	prismat	mined	Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Connecticut	3,466	8.3	37	1.1	(1)	0	0	0	0	15	0.4	0	0	0.1
East Hartford														343
Massachusetts														9.9
Malden	3,474	12.7	1	T	0	0	0	0	0	5	1	4	0.1	1
Taunton	9,731	76	8	297	3.1	779	8.0	52	0.6	3	T	48	5	7
New Jersey														1.1
Atlantic	735	5	7	1	0.1	(1)	0	0	0	0	0	0	0	1
Burlington	1,027	0	0	(1)	0	0	1	0.1	(1)	0	0	0	0	1
Virginia														6
Lee	1,879	0	0	179	9.5	(1)	0	0	0	0	0	0	0	2
Total	20,312	810	515	782	53	3	69	11	23	23	23	23	23	2,266

1/ No release of this species at points indicated.

Status of Parasites as Determined by the 1938 Surveys

Lydella stabulans var. grisea R. D.--In the Lake States area special surveys were conducted to determine the distribution of this tachinid in the vicinity of marshland near the bays, inlets, and shorelines of Lake Erie and the Detroit River. These observations were intended to supplement information on the dispersion of Lydella grisea as obtained from surveys of similar type in previous years and to furnish possible data of value in interpreting the limitations on its distribution. The tachinid was found to be present in a band several miles wide near all marshland from the Huron River east of Sandusky, Ohio, to the outskirts of Detroit, Mich., a distance of over 130 miles. Within this area are several points at which L. grisea has been released. A fairly uniform decrease in population density was noted as the distance from the release points increased, indicating that dispersion was still occurring. At 3 test points near Lake Erie the increase in population noted from surveys of similar type, made in several previous years, has continued. At Jerusalem Township, Lucas County, one of the older test points, an increase was noted in each of the 5 rings of the polar coordinate sampling design utilized at this point. Parasitizations, chiefly by L. grisea, of over 80 percent were obtained and among borers from 11 sections nearest the marsh the average was over 40 percent. The distribution of the species in Jerusalem Township in the fall of 1938 is shown on map 1. The annual fall parasitization by L. grisea for the last 7 years at this colony is given in table 3.

Table 3.--Annual fall parasitization by Lydella grisea about the Jerusalem Township, Ohio, release point

Year	Parasitization within radius of release	
	3 1/2 miles	7 1/2 miles
	Percent	Percent
1932-----	0.3	--
1933-----	2.8	--
1934-----	6.3	--
1935-----	7.6	4.4
1936-----	10.0	7.0
1937-----	17.1	9.6
1938-----	21.3	11.4

Although Lydella grisea has been present in Jerusalem Township for 9 years, it is not yet evident that this species has attained environmental equilibrium. In Perkins Township, Erie Co., Ohio, another of the older release points, the parasitization by L. grisea increased about 350 percent in 1938 over that of 1937. The parasitization at this point in the immediate vicinity of the colony site for the last 7 years is given in table 4.

Table 4.--Annual fall parasitization by *Lydella grisescens* about the Perkins Township, Ohio, release point

Year	Parasitization within 1 1/2 mile radius of colony site	
	Percent	
1932 -----	:	3.8
1933 -----	:	15.7
1934 -----	:	7.3
1935 -----	:	.8
1936 -----	:	.8
1937 -----	:	8.4
1938 -----	:	38.1

In the Eastern States area *Lydella grisescens* was recovered in all surveys made at points where the parasite had been released. It was apparently of no importance at the Malden, Mass., or Atlantic, N. J., points. At Hartford, Conn., little increase in the percentage of parasitization was noted but there was a considerable increase in the area from which the parasite was recoverable. A dispersion of this species more uniform than in previous years was found in the Taunton, Mass., district, where the average parasitization had increased from 1.2 percent in 1937 to 2.5 percent in 1938. Map 2 shows the distribution at this point.

At one release point in Accomac County, on the Eastern Shore of Virginia, not only was there a decided increase in percentage of borers parasitized (probably partly due to a greatly decreased host population), but an extensive dispersion of the parasite took place. Although the territory surveyed in Virginia was increased from approximately 38 square miles in the fall of 1937 to over 70 square miles in 1938, the number of *L. grisescens* obtained from hosts collected near the boundary of the surveyed region, and the fact that there was a greater proportion of parasites in borers from the periphery of the survey than in those from the central portion, indicated that the parasite had dispersed beyond the limits of the district surveyed. The apparently favorable reaction of *L. grisescens* to the environment of this district may be due to the extensive area of marshland found on the Eastern Shore of Virginia.

Inareolata punctoria Roman.--No specimens of this ichneumonid were recovered in the collections made in the Lake States area in the fall of 1938. In the Eastern States, however, the parasite was recovered in numbers from the vicinity of the Malden and Taunton, Mass., and Hartford, Conn., release points. The two distinct areas in which *I. punctoria* is found near the Taunton, Mass., point, representing spread from two colony sites, were found to have moved closer together in 1938. (See map 2.) The greatest increase in parasitization by *I. punctoria* occurred in the East Hartford, Conn., district, where the area in which it was found was extended by 273 percent and the percentage of parasitization increased more than 100 percent in 1938 over 1937. Map 3 shows the territory occupied by this parasite as determined by the fall surveys of 1936, 1937, and 1938.

Macrocentrus gifuensis Ashn.--The polyembryonic larval parasite Macrocentrus gifuensis increased greatly in the Taunton, Mass., district during the 1938 season. The average parasitization by this species for the entire area covered in this district increased from 1 percent in the fall of 1937 to 8 percent in the fall of 1938. From the central 500-square-mile portion of the area, recorded parasitization increased from 1.9 percent in the fall of 1937 to 3.9 percent on the first generation of the host in the summer of 1938, and continued to increase to average 10.8 percent on the second generation in the fall of 1938. Forty-seven of the 100 collections made in the Taunton area in the fall of 1938 produced M. gifuensis and, in the 47 collections, 15 showed a parasitization by this species of over 20 percent. The maximum parasitization by M. gifuensis for any collection was 56.3 percent, as compared with a maximum of 33 percent in a collection in the 1937 fall survey. The district of highest concentration was that territory within 10 miles of the release point at East Bridgewater, Mass. A total of 779 cocoon masses were produced and 15,055 adults obtained. In the Taunton district the area in which M. gifuensis was found increased from 278 square miles in the fall of 1937 to approximately 715 square miles in the fall of 1938. Map 2 shows the distribution of M. gifuensis as determined by the survey at the close of 1938. In view of the remarkable increase in numbers and distribution of M. gifuensis, it should be mentioned that as late as the fall of 1935 the parasite was not recovered in collections taken specifically to obtain it. Therefore, while present in the field, it must have been very scarce. The last release of this parasite in the area it now occupies was made in 1932.

Chelonus annulipes Wesm.--Initial establishment of this egg-larval parasite, following current releases, was noted in 1938 in Adams Township, Lucas County, Ohio, and at Burlington, N. J. At Taunton, Mass., the parasite was still on a maintenance basis but a decrease in percentage of parasitization was shown. Although the number of sections from which this braconid was recovered was not increased in 1938 over that of 1937, the area from which the species was taken was somewhat extended. It is estimated that C. annulipes is now present over an area of 292 square miles in southeastern Massachusetts, an increase since 1937 in the known occupied area of 142 square miles having been established as a result of the fall survey of 1938.

Cremastus flavoorbitalis (Cam.).--The larval parasite C. flavoorbitalis was recovered in 1938 only from the vicinity of Taunton, Mass., where it has been on a maintenance basis in small numbers for at least 5 years.

Eulophus viridulus Thoms.--In the 1938 fall surveys this octophagous chalcid parasite was found on a maintenance basis for the first time in the United States. It was first noted by C. A. Crooks while he was examining larvae in weeds in Jerusalem Township, Lucas County, Ohio, in the fall of 1938. During the fall survey of that year the parasite was taken in collections of borers in corn from 12 of the 51 sections sampled. This condition is in accordance with observations in Europe where a definite migration from borers in Artemisia, in

1/ Nine thousand adults of Macrocentrus gifuensis were shipped to the Dominion Parasite Laboratory at Belleville, Ontario, Canada, for experimental use and 1,100 adults were consigned to the Division of Foreign Parasite Introduction and subsequently shipped to Puerto Rico for testing on insect pests of that island.

the case of the summer generation, to borers in corn for the winter generation, has been noted. The last release of E. viridulus at the Jerusalem release point was made in 1932, thus showing maintenance for 6 years. The greatest dispersion from the Jerusalem colony site was about 5 miles. E. viridulus was also recovered at Erie Township, Monroe Co., Mich., and at Danbury, Ohio. The nearest release to the latter recovery point was about 8 miles, 4 miles of which were across the water of Sandusky Bay. E. viridulus was also found attacking two native borers, Pyrausta ainsliei Heinrich and Pyrausta penitalis Grote. This is the first record of an exotic parasite of the European corn borer attacking a native host.

Native parasites.---In the Eastern States area the following native parasites were recovered: Bassus agilis Cresson, Labrorvchus prismaticus Nort., Macrocentrus robustus Mues., and Amblyteles brevicinctor Say. From borers collected in the Lake States area there were obtained Zenillia caesar Ald., Panzeria penitalis Coq., and Labrorvchus prismaticus Nort. In no case was the parasitization by native species important.

Summary

Surveys were conducted at the close of the 1938 season to determine the status of exotic and native parasites of the European corn borer in the vicinity of liberation points in the United States.

The tachinid, Lydella stabulans var. griseescens was found in greatest abundance near marshland along the shores of Lake Erie and the Detroit River. In this area parasitizations as high as 80 percent, chiefly by L. griseescens, were observed and in restricted localities parasitization by this species was higher than that by all other species combined in any other area.

An exceptional increase in the area from which parasites were recovered and in the percentage of parasitization was noted at the release point in Accomac County, Va., where marshland thought to be favorable for the increase of this fly is prevalent.

Macrocentrus gifuensis made a remarkable increase in the vicinity of release points in southeastern New England, after failing to appear in host collections for several years following liberation.

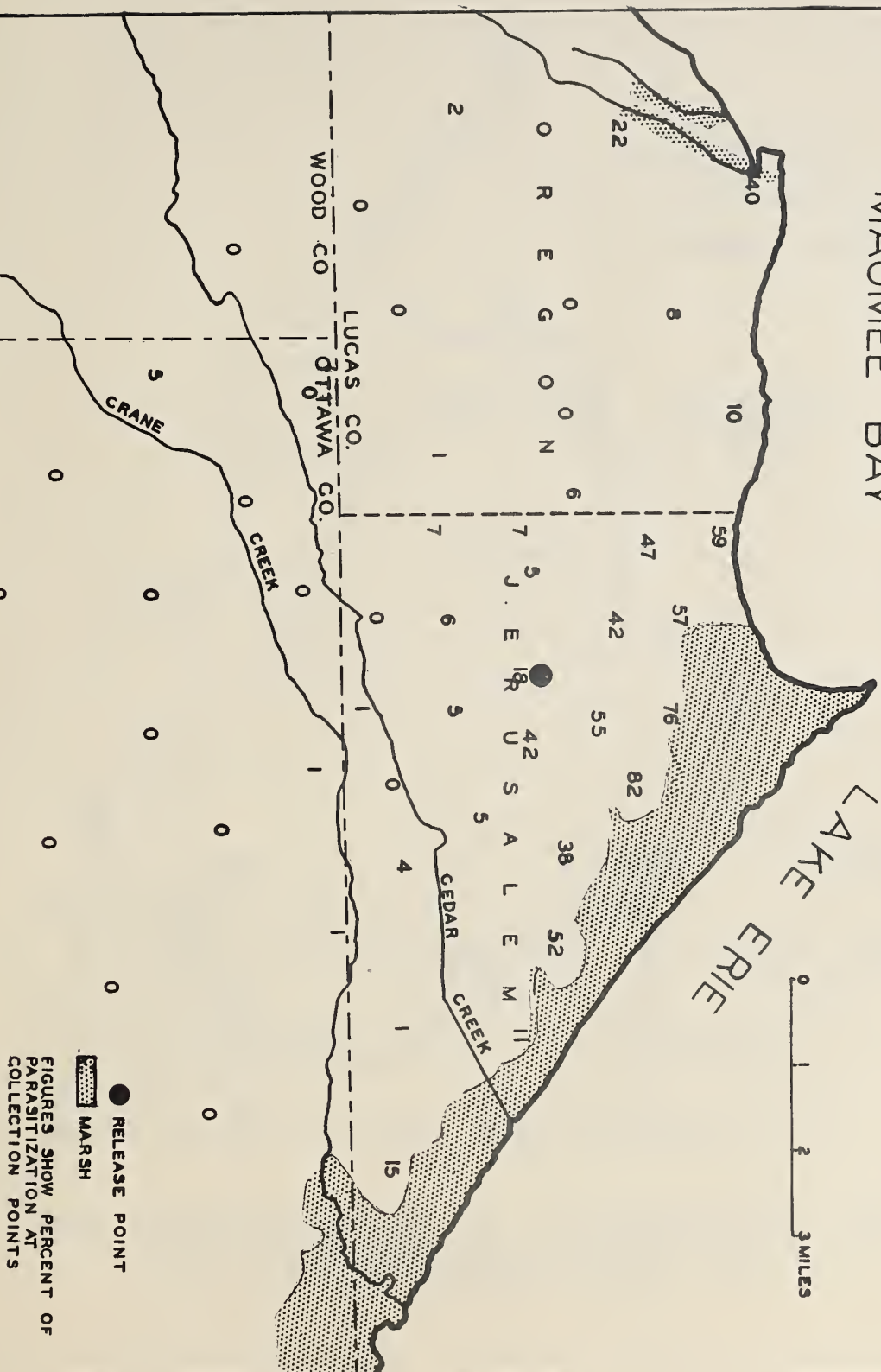
Inareolata punctoria was the most generally distributed and abundant parasite at the eastern survey points.

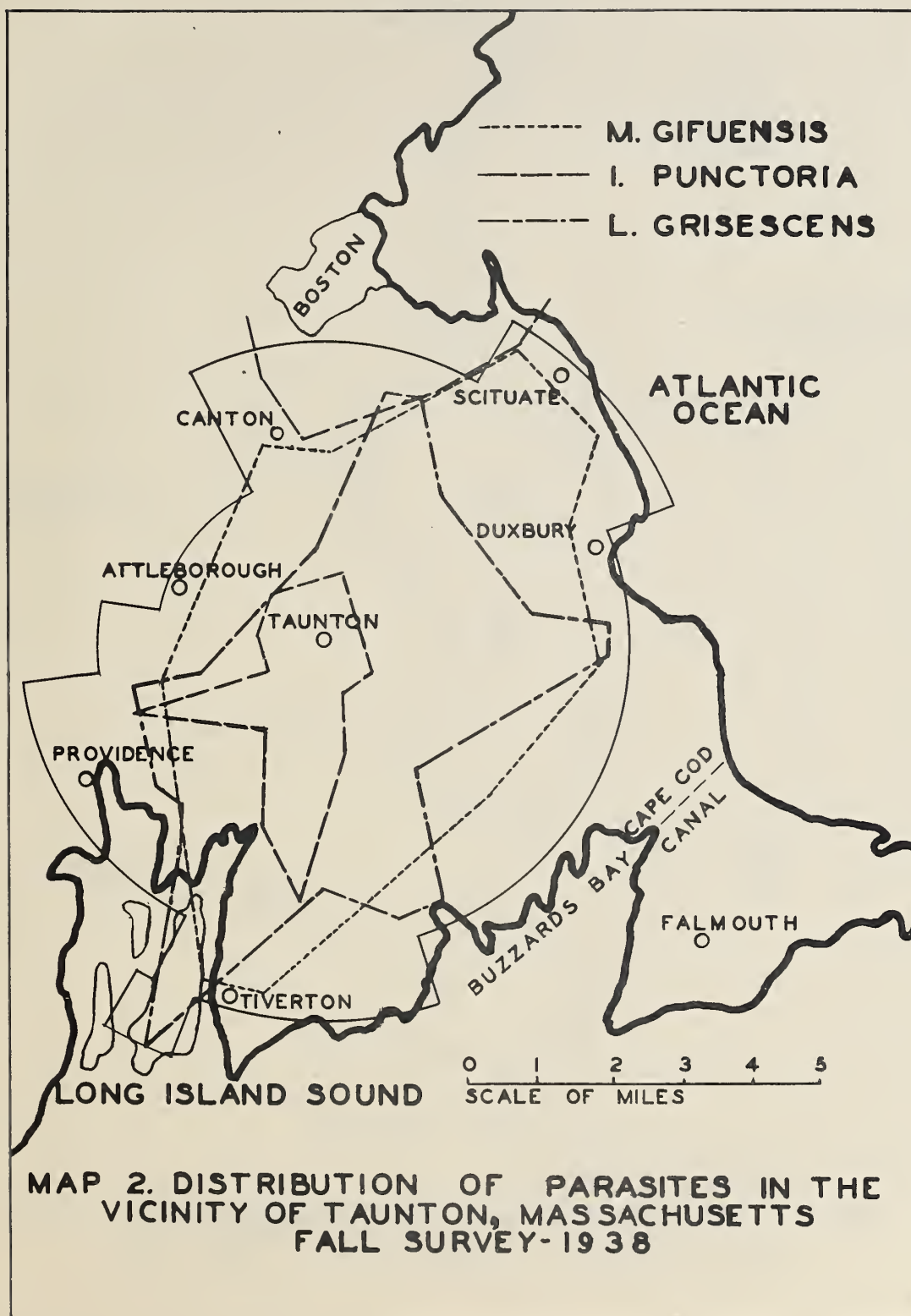
Chelonus annulipes had increased its range in the Taunton, Mass., area.

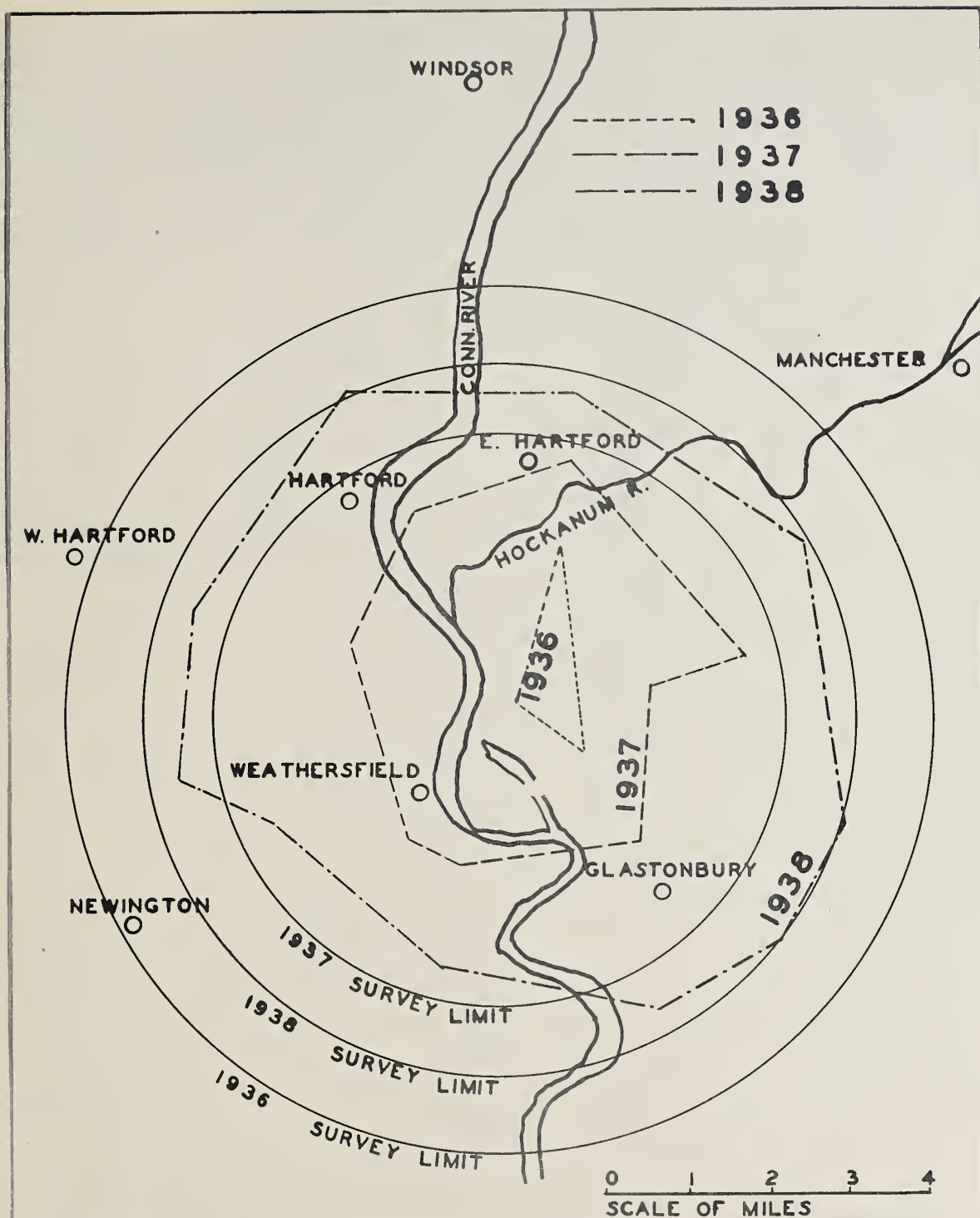
Eulophus viridulus was recovered in Ohio on a maintenance basis for the first time since its introduction in 1931 and 1932. Two native borers, Pyrausta ainsliei and Pyrausta penitalis, were found parasitized by this species.

Five species of native parasites were found but in no case did the percentage of parasitization reach important proportions.

MAPI. DISTRIBUTION OF LYDELLA GRISESCENS AT JERUSALEM TOWNSHIP,
LUCAS COUNTY, OHIO - FALL SURVEY-1936







**MAP 3 DISTRIBUTION OF INAREOLATA PUNCTORIA
AT EAST HARTFORD, CONNECTICUT**

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